WHAT IS CLAIMED IS:

1. An ultrasonic atomizer comprising:

an ultrasonic pump comprising a pump shaft formed to have a pump bore passing through it axially and having open upper and lower ends, and an ultrasonic vibrator mounted on the pump shaft in the vicinity of the midpoint thereof with respect to the axial direction;

a liquid vessel provided at a position at which it is penetrated by a lower end of said pump shaft;

a mesh plate placed on an upper end face of said pump shaft and formed to have a multiplicity of minute holes; and

a biasing resilient member for biasing said mesh plate toward the upper end face of said pump shaft.

2. An ultrasonic atomizer according to claim 1, further comprising:

a housing, to which said liquid vessel is attached in a freely detachable manner, for supporting said ultrasonic pump; and

a cap attached to a portion of said housing in a freely detachable manner so as to cover the upper end of said pump shaft;

a top side of said cap being provided with a spray port, a step portion being formed for supporting said mesh plate at the periphery thereof at a position beneath said spray port, and a biasing resilient member being provided between a portion of the top side of said

cap and said mesh plate.

3. An ultrasonic atomizer according to claim 1 or 2, wherein said mesh plate is biased by said biasing member so as to be contactable with the upper end face of said pump shaft at least in an area of said upper end face that includes the opening in the upper end of the pump bore.

4. An ultrasonic atomizer according to any one of claims 1 through 3, wherein the upper end face of said pump shaft is formed to have a shape in which the upper end face is slightly and smoothly curved so as to attain maximum height at the position of the opening in the upper end of the pump bore and diminish in height as the periphery is approached.

5. An ultrasonic atomizer according to claim 4, wherein said mesh plate is curved slightly by being biased by said resilient member at a peripheral edge extending outwardly from the upper end face of said pump shaft, and curvature of the upper end face of said pump shaft, elastic force of said resilient member and strength of said mesh plate are decided in such a manner that the degree of curvature of said mesh plate is less than degree of curvature of the upper end face of said pump shaft.

6. An ultrasonic atomizer according to any of claims 1 through 3, wherein the upper end face of said pump shaft is formed to have a protuberance which projects in an area that includes the opening in the upper end of said

pump bore.

7. An ultrasonic atomizer according to any of claims 1 through 3, wherein said mesh plate is formed to have a shape in which the central portion thereof is bent or curved slightly so as to point downward.

8. An ultrasonic atomizer according to any of claims 1 through 7, wherein said biasing resilient member is a compression coil spring.

9. An ultrasonic atomizer according to any of claims 1 through 7, wherein said biasing resilient member is a compression coil spring having a coil diameter which becomes progressively smaller as said mesh plate is approached, in such a manner that said mesh plate is biased at a position thereof situated on the upper end face of said pump shaft.

10. An ultrasonic atomizer according to any of claims 1 through 9, wherein the minute holes of said mesh plate are formed so as to flare outwardly in a direction extending from the top side to the bottom side of said mesh plate.

11. An ultrasonic atomizer according to any of claims 1 through 9, wherein said mesh plate is formed to have a shape in which the minute holes flare outwardly in a direction extending from the top side to the bottom side of said mesh plate, and a groove or recess is formed in the top side between mutually adjacent ones of the minute holes.

12. An ultrasonic atomizer according to any of claims 1

through 11, wherein cut-outs of different size are formed in the periphery of said mesh plate at least at two locations other than locations having point symmetry about the center of said mesh plate.

13. An ultrasonic atomizer according to any of claims 1 through 12, wherein said minute holes are formed at equal intervals long sides of a multiplicity of regular hexagons whose diagonals vary at fixed distances.

14. An ultrasonic atomizer according to any of claims 1 through 13, wherein a small area devoid of formation of minute holes is present in said mesh plate in an area surrounded by said minute holes.

15. An ultrasonic atomizer according to any of claims 1 through 14, wherein a small area devoid of formation of minute holes is present in said mesh plate, at a location opposing the opening in the upper end of the pump bore of said pump shaft, over a region broader than said opening.

16. An ultrasonic atomizer according to any of claims 1 through 15, wherein the peripheral portion of said mesh plate is provided with an annular plate in order that biasing force produced by said biasing member will be applied to said mesh plate uniformly.

17. An ultrasonic atomizer according to any of claims 1 through 15, wherein a spacer is provided between said mesh plate and the upper end face of the pump shaft.

18. An ultrasonic atomizer according to claim 1, further comprising a bush for encircling and supporting

liquid tightly a portion of said pump shaft of said ultrasonic pump excluding upper and lower end portions of said pump shaft;

an annular seal lip, in intimate liquid-tight contact with a portion of the pump shaft situated higher than said ultrasonic vibrator, being formed integrally at least at two locations, one above the other, on an upper portion of said bush, and a gap being provided between said portion of the pump shaft and said bush between the annular seal lips at the at least two locations one above the other.

19. An ultrasonic atomizer according to claim 1, further comprising:

a bush for encircling and supporting liquid tightly a portion of said pump shaft of said ultrasonic pump excluding upper and lower end portions of said pump shaft;

a housing in which said bush is fitted liquid tightly; and

a cap attached in a freely detachable manner to an annular projecting wall, which is formed on said housing about the upper end portion of said pump shaft, so as to cover the upper end portion of said pump shaft;

a reservoir being formed with a top side of said bush serving as its bottom surface and at least one of said cap and said annular projecting wall serving as its peripheral wall.

20. An ultrasonic atomizer according to claim 1,

wherein a lower end of said pump shaft is disposed in close proximity to a bottom surface or side surface of said liquid vessel in such a manner that residual liquid remaining inside said liquid vessel is pumped upon attaching itself to the lower end of the pump shaft by surface tension.

21. An ultrasonic atomizer according to any one of claims 1 through 20, wherein said liquid vessel is formed to have a recess for collecting the residual liquid remaining inside said liquid vessel, and the lower end of said pump shaft is disposed so as to face said recess.

22. An ultrasonic atomizer according to claim 1, further comprising:

a drive circuit for driving the ultrasonic vibrator of said ultrasonic pump;

an operating switch;

first control means responsive to on/off operation of said operating switch for controlling drive of said ultrasonic vibrator by said drive circuit; and

second control means which, in response to said operating switch being turned on and off one time or a plurality of times, is for deciding ON time and OFF time in automatic intermittent operation on the basis of ON time and OFF time of said operating switch, and controlling said drive circuit in such a manner that said ultrasonic vibrator is driven at a period of the ON time and OFF time decided.

23. A mesh plate used to produce an ultrasonic atomizing action, comprising a single plate-shaped body having two surfaces overall and formed to include a multiplicity of minute holes passing through the plate-shaped body from one surface to the other surface, said plate-shaped body being continuously deformed at the location of each minute hole in such a manner that each minute hole flares in a direction from the one surface to the other surface and a groove or recess is formed in said one surface between mutually adjacent ones of the minute holes.

24. An ultrasonic atomizer according to claim 23, wherein cut-outs of different size are formed in the periphery of said mesh plate at least at two locations other than locations having point symmetry about the center of said mesh plate.

25. An ultrasonic atomizer according to claim 23, wherein said minute holes are formed at equal intervals along sides of a multiplicity of regular hexagons whose diagonals vary at fixed distances.

26. An ultrasonic atomizer according to claim 23, wherein a small area devoid of formation of minute holes is present in an area surrounded by said minute holes.

27. An ultrasonic atomizer according to claim 23, wherein an area devoid of said minute holes is present at a central portion.

28. An ultrasonic atomizer in which a liquid inside a liquid vessel is supplied to one side of a mesh plate

formed to have a multiplicity of minute holes and said mesh plate is vibrated by an ultrasonic vibrator, whereby the liquid supplied to said one side of the mesh plate is sprayed from the other side of said mesh plate, characterized in that said mesh plate is constructed from a plate-shaped body formed to have a groove or recess between mutually adjacent ones of said minute holes, said plate-shaped body being bent in such a manner that peripheral wall surfaces of said minute holes project from said one side.

29. An ultrasonic atomizer according to claim 28, wherein said minute holes flare outwardly from said other side to said one side.

30. An ultrasonic atomizer according to claim 28 or 29, wherein cut-outs of different size are formed in the periphery of said mesh plate at least at two locations other than locations having point symmetry about the center of said mesh plate.

31. An ultrasonic atomizer according to claim 28 or 29, wherein said minute holes are formed in said mesh plate at equal intervals along sides of a multiplicity of regular hexagons whose diagonals vary at fixed distances.

32. An ultrasonic atomizer according to claim 28 or 29, wherein a small area devoid of formation of minute holes is present in said mesh plate in an area surrounded by said minute holes.

33. An ultrasonic atomizer according to claim 28 or 29,

wherein a small area devoid of formation of minute holes is present in said mesh plate, at a location opposing a liquid-supply port, over a region broader than said supply port.

34. An ultrasonic atomizer comprising:

an ultrasonic pump comprising a pump shaft formed to have a pump bore passing through it axially and having open upper and lower ends, and an ultrasonic vibrator mounted on the pump shaft in the vicinity of the midpoint thereof with respect to the axial direction;

a liquid vessel provided at a position at which it is penetrated by a lower end of said pump shaft;

a mesh plate placed on an upper end face of said pump shaft and formed to have a multiplicity of minute holes;

a biasing resilient member for biasing said mesh plate toward the upper end face of said pump shaft; and

an annular plate provided on a peripheral portion of said mesh plate, or a spacer provided between said mesh plate and the upper end face of said pump shaft, in order that biasing force produced by said biasing member may be applied to said mesh plate uniformly.

35. An ultrasonic atomizer having an ultrasonic pump comprising a pump shaft formed to have a pump bore passing through it axially and having open upper and lower ends, and an ultrasonic vibrator mounted on the pump shaft in the vicinity of the midpoint thereof with

respect to the axial direction, wherein a liquid inside a liquid vessel is pumped up from the lower end of said pump bore and the liquid is supplied to a mesh plate from the upper end of said pump bore so as to be sprayed, characterized in that a bush is provided for encircling and supporting liquid tightly a portion of said pump shaft of said ultrasonic pump excluding upper and lower end portions of said pump shaft, an annular seal lip, in intimate liquid-tight contact with a portion of said pump shaft situated higher than said ultrasonic vibrator, is formed integrally at least at two locations, one above the other, on an upper portion of said bush, and a gap is provided between said portion of the pump shaft and said bush between said annular seal lips at the at least two locations.

36. An ultrasonic atomizer comprising:

an ultrasonic pump comprising a pump shaft formed to have a pump bore passing through it axially and having open upper and lower ends, and an ultrasonic vibrator mounted on the pump shaft in the vicinity of the midpoint thereof with respect to the axial direction;

a liquid vessel provided at a position at which it is penetrated by a lower end of said pump shaft;

a mesh plate placed on an upper end face of said pump shaft and formed to have a multiplicity of minute holes;

a biasing resilient member for biasing said mesh

plate toward the upper end face of said pump shaft;

a bush for encircling and supporting liquid tightly a portion of said pump shaft of said ultrasonic pump excluding upper and lower end portions of said pump shaft;

a housing in which said bush is fitted liquid tightly; and

a cap attached in a freely detachable manner to an annular projecting wall, which is formed on said housing about the upper end portion of said pump shaft, so as to cover the upper end portion of said pump shaft;

a reservoir being formed with a top side of said bush serving as its bottom surface and at least one of said cap and said annular projecting wall serving as its peripheral wall.

37. An ultrasonic atomizer according to claim 36, wherein a top side of said cap is provided with a spray port, a step portion is formed for supporting said mesh plate at the periphery thereof at a position beneath said spray port, and a biasing resilient member being provided between a portion of the top side of said cap and said mesh plate.

38. An ultrasonic atomizer having:

a liquid vessel for accommodating a liquid to be atomized; and

an ultrasonic pump comprising a pump shaft having a lower end situated inside said liquid vessel and formed to have a pump bore passing through the pump

shaft axially and having open upper and lower ends, and an ultrasonic vibrator mounted on the pump shaft;

characterized in that a lower end of said pump shaft is disposed in close proximity to a bottom surface or side surface of said liquid vessel in such a manner that residual liquid remaining inside said liquid vessel is pumped upon attaching itself to the lower end of the pump shaft by surface tension.

39. An ultrasonic atomizer according to claim 38, wherein said liquid vessel is formed to have a recess for collecting the residual liquid remaining inside said liquid vessel, and the lower end of said pump shaft is disposed so as to face said recess.

40. An ultrasonic atomizer according to claim 38 or 39, wherein said liquid vessel is freely attachable and detachable.

41. An ultrasonic inhaler having an ultrasonic pump comprising a pump shaft formed to have a pump bore passing through it axially, and an ultrasonic vibrator mounted on said pump shaft, wherein liquid is pumped through said pump shaft and sprayed by ultrasonic vibration, characterized by comprising:

a drive circuit for driving the ultrasonic vibrator of said ultrasonic pump;

an operating switch;

first control means responsive to on/off operation of said operating switch for controlling drive of said ultrasonic vibrator by said drive circuit; and

second control means which, in response to said operating switch being turned on and off one time or a plurality of times, is for deciding ON time and OFF time in automatic intermittent operation on the basis of ON time and OFF time of said operating switch, and controlling said drive circuit in such a manner that said ultrasonic vibrator is driven at a period of the ON time and OFF time decided.

42. An ultrasonic inhaler according to claim 41, wherein said second control means is started so as to perform the automatic intermittent operation in response to on/off operation of said operating switch repeated a requisite plurality of times.

43. An ultrasonic inhaler according to claim 42, wherein said second control means makes a transition to the automatic intermittent operation upon verifying that ON time of said operating switch the last time in the requisite plurality of times is greater than a first prescribed time.

44. An ultrasonic atomizer according to claim 41, further provided with an automatic intermittent-operation mode switch is provided, said second control means being started so as perform the automatic intermittent operation in response to an input from said automatic intermittent-operation mode switch.

45. An ultrasonic atomizer according to claim 41, further provided with third control means for controlling said drive circuit so as to drive said

ultrasonic vibrator continuously in response to ON time of said operating switch that is greater than a second predetermined time.

46. A method of controlling an ultrasonic inhaler having an ultrasonic pump comprising a pump shaft formed to have a pump bore passing through it axially, and an ultrasonic vibrator mounted on said pump shaft, wherein liquid is pumped through said pump shaft and sprayed by ultrasonic vibration, said method comprising the steps of:

driving said ultrasonic vibrator during time which an operating switch is ON when said operating switch has been turned on, and measuring the ON time;

halting drive of said ultrasonic vibrator during time which the operating switch is OFF when said operating switch has been turned off, and measuring the OFF time; and

deciding ON time and OFF time in automatic intermittent operation on the basis of the measured ON time and OFF time of said operating switch after said operating switch has been turned on and off a prescribed number of times, and driving said ultrasonic vibrator at a period of the ON time and OFF time decided.